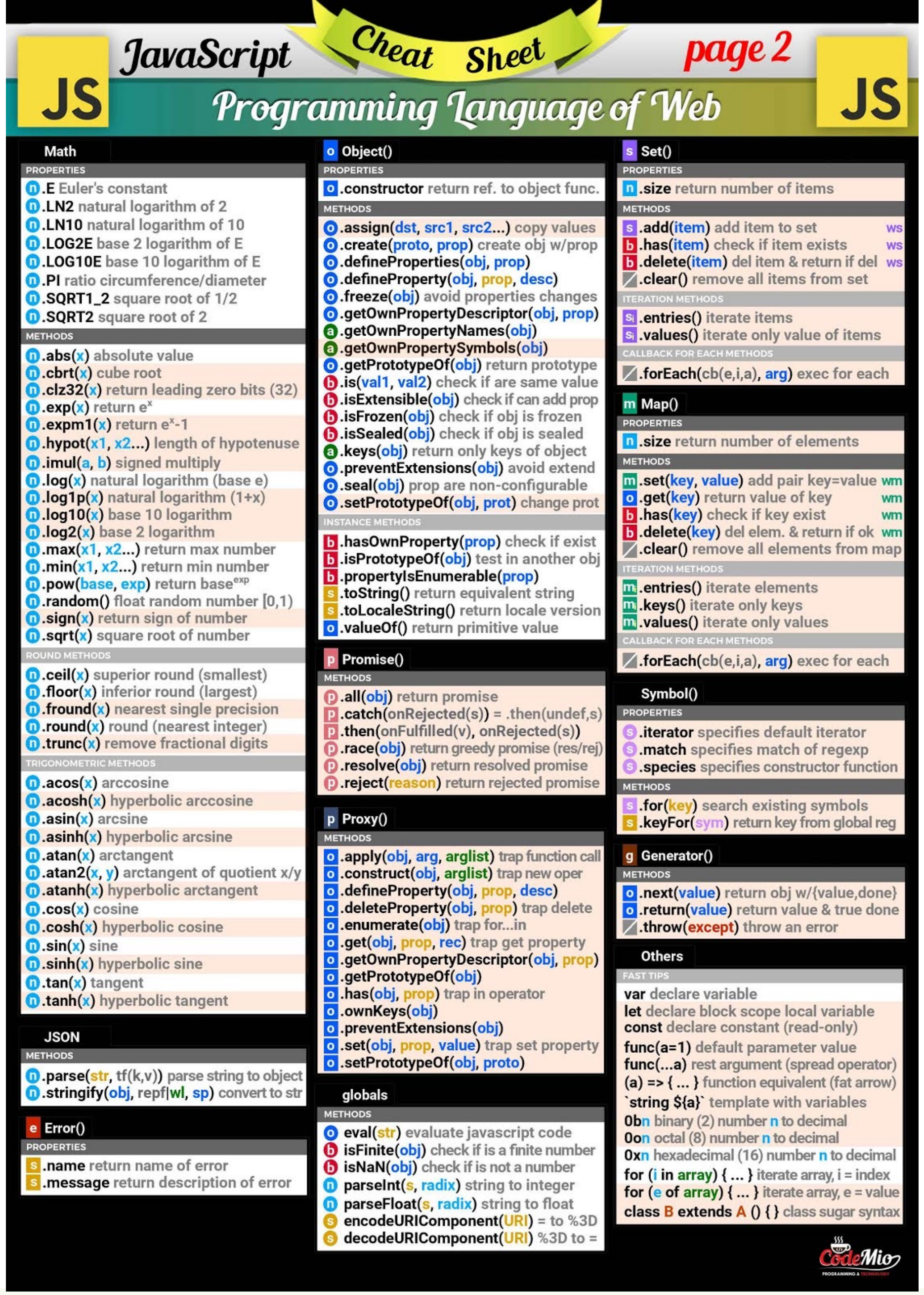
<WA1/>
<AW1/>
2023

JavaScript: Objects and Functions

"The" language of the Web

Fulvio Corno
Luigi De Russis
Enrico Masala


JS JavaScript Cheat Sheet page 2 JS
Programming Language of Web

Math
PROPERTIES
.E Euler's constant
.LN2 natural logarithm of 2
.LN10 natural logarithm of 10
.LOG2E base 2 logarithm of E
.LOG10E base 10 logarithm of E
.PI ratio circumference/diameter
.SQRT1_2 square root of 1/2
.SQRT2 square root of 2
METHODS
.abs(x) absolute value
.cbrt(x) cube root
.clz32(x) return leading zero bits (32)
.exp(x) return e^x
.expm1(x) return e^x-1
.hypot(x1, x2...) length of hypotenuse
.imul(a, b) signed multiply
.log(x) natural logarithm (base e)
.log1p(x) natural logarithm (1+x)
.log10(x) base 10 logarithm
.log2(x) base 2 logarithm
.max(x1, x2...) return max number
.min(x1, x2...) return min number
.pow(base, exp) return $base^{exp}$
.random() float random number [0,1)
.sign(x) return sign of number
.sqrt(x) square root of number
ROUND METHODS
.ceil(x) superior round (smallest)
.floor(x) inferior round (largest)
.fround(x) nearest single precision
.round(x) round (nearest integer)
.trunc(x) remove fractional digits
TRIGONOMETRIC METHODS
.acos(x) arccosine
.acosh(x) hyperbolic arccosine
.asin(x) arcsine
.asinh(x) hyperbolic arcsine
.atan(x) arctangent
.atan2(x, y) arctangent of quotient x/y
.atanh(x) hyperbolic arctangent
.cos(x) cosine
.cosh(x) hyperbolic cosine
.sin(x) sine
.sinh(x) hyperbolic sine
.tan(x) tangent
.tanh(x) hyperbolic tangent

JSON
METHODS
.parse(str, tf(k,v)) parse string to object
.stringify(obj, repf|wl, sp) convert to str

Error()
PROPERTIES
.name return name of error
.message return description of error

Object()
PROPERTIES
.constructor return ref. to object func.
METHODS
.assign(dst, src1, src2...) copy values
.create(proto, prop) create obj w/prop
.defineProperties(obj, prop)
.defineProperty(obj, prop, desc)
.freeze(obj) avoid properties changes
.getOwnPropertyDescriptor(obj, prop)
.getOwnPropertyNames(obj)
.getOwnPropertySymbols(obj)
.getPrototypeOf(obj) return prototype
.is(val1, val2) check if are same value
.isExtensible(obj) check if can add prop
.isFrozen(obj) check if obj is frozen
.isSealed(obj) check if obj is sealed
.keys(obj) return only keys of object
.preventExtensions(obj) avoid extend
.seal(obj) prop are non-configurable
.setPrototypeOf(obj, prot) change prot
INSTANCE METHODS
.hasOwnProperty(prop) check if exist
.isPrototypeOf(obj) test in another obj
.propertyIsEnumerable(prop)
.toString() return equivalent string
.toLocaleString() return locale version
.valueOf() return primitive value

Promise()
METHODS
.all(obj) return promise
.catch(onRejected(s)) = .then(undef,s)
.then(onFulfilled(v), onRejected(s))
.race(obj) return greedy promise (res/rej)
.resolve(obj) return resolved promise
.reject(reason) return rejected promise

Proxy()
METHODS
.apply(obj, arg, arglist) trap function call
.construct(obj, arglist) trap new oper
.defineProperty(obj, prop, desc)
.deleteProperty(obj, prop) trap delete
.enumerate(obj) trap for...in
.get(obj, prop, rec) trap get property
.getOwnPropertyDescriptor(obj, prop)
.getPrototypeOf(obj)
.has(obj, prop) trap in operator
.ownKeys(obj)
.preventExtensions(obj)
.set(obj, prop, value) trap set property
.setPrototypeOf(obj, proto)

globals
METHODS
eval(str) evaluate javascript code
isFinite(obj) check if is a finite number
isNaN(obj) check if is not a number
parseInt(s, radix) string to integer
parseFloat(s, radix) string to float
encodeURIComponent(URI) = to %3D
decodeURIComponent(URI) %3D to =

Set()
PROPERTIES
.size return number of items
METHODS
.add(item) add item to set ws
.has(item) check if item exists ws
.delete(item) del item & return if del ws
.clear() remove all items from set
ITERATION METHODS
.entries() iterate items
.values() iterate only value of items
CALLBACK FOR EACH METHODS
.forEach(cb(e,i,a), arg) exec for each

Map()
PROPERTIES
.size return number of elements
METHODS
.set(key, value) add pair key=value wm
.get(key) return value of key wm
.has(key) check if key exist wm
.delete(key) del elem. & return if ok wm
.clear() remove all elements from map
ITERATION METHODS
.entries() iterate elements
.keys() iterate only keys
.values() iterate only values
CALLBACK FOR EACH METHODS
.forEach(cb(e,i,a), arg) exec for each

Symbol()
PROPERTIES
.iterator specifies default iterator
.match specifies match of regexp
.species specifies constructor function
METHODS
.for(key) search existing symbols
.keyFor(sym) return key from global reg

Generator()
METHODS
.next(value) return obj w/{value,done}
.return(value) return value & true done
.throw(except) throw an error

Others
FAST TIPS
var declare variable
let declare block scope local variable
const declare constant (read-only)
func(a=1) default parameter value
func(...a) rest argument (spread operator)
(a) => { ... } function equivalent (fat arrow)
\`string ${a}\` template with variables
0bn binary (2) number n to decimal
0on octal (8) number n to decimal
0xn hexadecimal (16) number n to decimal
for (i in array) { ... } iterate array, i = index
for (e of array) { ... } iterate array, e = value
class B extends A () { } class sugar syntax

CodeMio
PROGRAMMING & TECHNOLOGY

Outline

- Objects
- Functions
  - Closures
- Dates

JavaScript: The Definitive Guide, 7th Edition
Chapter 5. Objects

Mozilla Developer Network

- Learn web development JavaScript » Dynamic client-side scripting » Introducing JavaScript objects
- Web technology for developers » JavaScript » JavaScript reference » Standard built-in objects » Object
- Web technology for developers » JavaScript » JavaScript reference » Expressions and operators » in operator

JavaScript – The language of the Web

OBJECTS

Big Warnings *(a.k.a., forget Java objects)*

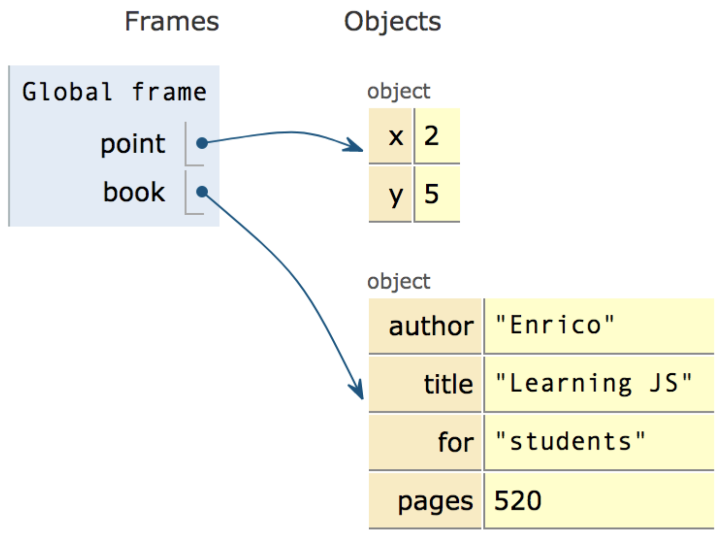
- In JavaScript, Objects may exist without Classes
  - Usually, Objects are created directly, without deriving them from a Class definition
- In JavaScript, Objects are dynamic
  - You may add, delete, redefine a *property* at any time
  - You may add, delete, redefine a *method* at any time
- In JavaScript, there are no access control methods
  - Every property and every method is always public (private/protected don't exist)
- There is no real difference between properties and methods (because of how JS functions work)

Object

- An object is an unordered collection of properties
  - Each property has a **name** (key), and a **value**
- You store and retrieve *property values*, through the *property names*
- Object creation and initialization:

```
let point = { x: 2, y: 5 };

let book = {
  author : "Enrico",
  title : "Learning JS",
  for: "students",
  pages: 520,
};
```

Object literals syntax:
`{"name": value, "name": value, }`
or:
`{name: value, name: value, }`



Object Properties

Property names are …

- Identified as a string
- Must be unique in each object
- Created at object initialization
- Added after object creation
  - With assignment
- Deleted after object creation
  - With `delete` operator

Property values are …

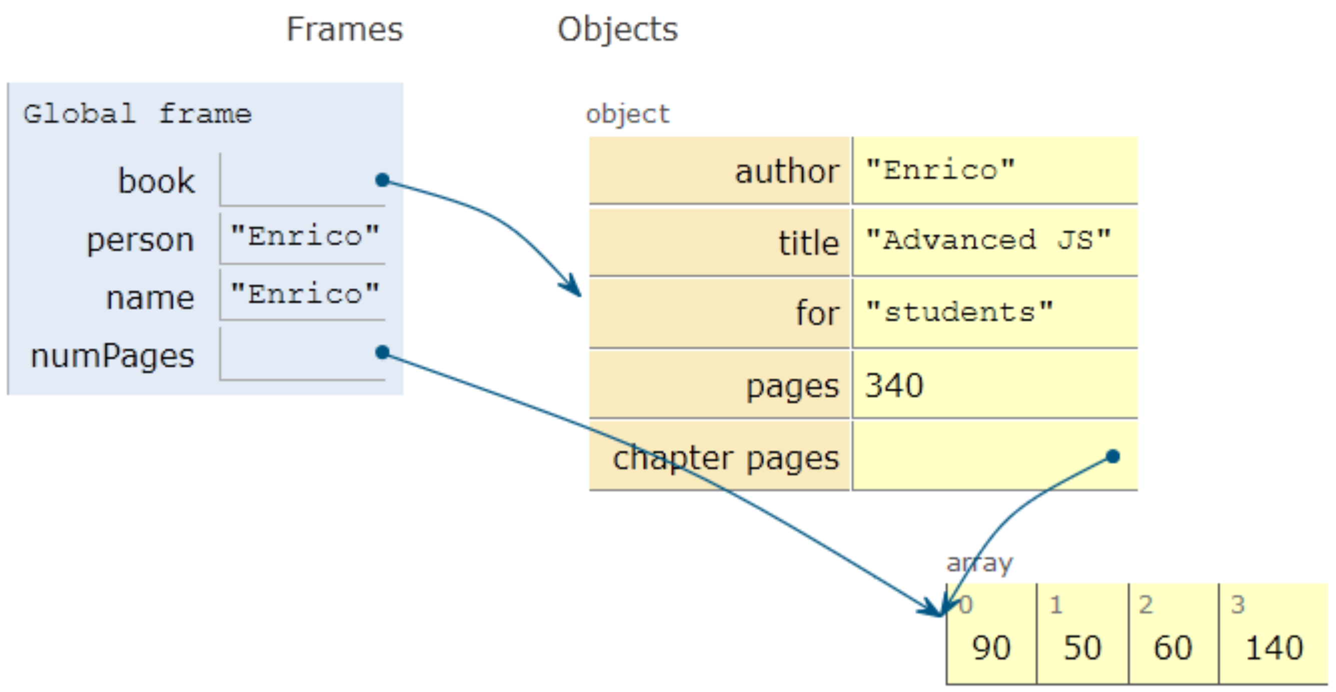
- Reference to any JS value
- Stored inside the object
- May be primitive types
- May be arrays, other objects, …
  - Beware: the object stores the reference, the value is *outside*
- May also be functions (*methods*)

Accessing properties

- Dot (.) or square brackets [ ] notation

The . dot notation and omitting the quotes are allowed **when the property name is a valid identifier, only**.
`book.title` or `book['title']`
`book['my title']` and not ~~`book.my title`~~

```
let book = {
  author : "Enrico",
  title : "Learning JS",
  for: "students",
  pages: 340,
  "chapter pages": [90,50,60,140]
};

let person = book.author;
let name = book["author"];
let numPages =
    book["chapter pages"];
book.title = "Advanced JS";
book["pages"] = 340;
```



Objects as associative arrays

- The [ ] syntax looks like array access, but the index is *a string*
  - Generally known as *associative arrays*
- Setting a non-existing property creates it:
  - `person["telephone"] = "0110901234";`
  - `person.telephone = "0110901234";`
- Deleting properties
  - `delete person.telephone;`
  - `delete person["telephone"];`

Computed property names

- Flexibility in creating object properties
  - `{[prop]:value}` -> creates an object with property name equal to *the value of the variable `prop`*
  - `[]` can contain more complex expressions: e.g., `i`-th line of an object with multiple "address" properties (address1, address2, …): `person["address"+i]`
    - **Using expressions is not recommended…**

- Beware of quotes:
  - `book["title"]` -> property called `title`
    - Equivalent to `book.title`
  - `book[title]` -> property called with the value of variable `title` (if exists)
    - If `title=="author"`, then equivalent to `book["author"]`
    - No equivalent in dot-notation

Property access errors

- If a property is not defined, the (attempted) access returns `undefined`
- If unsure, must check before accessing
  - Remember: `undefined` is *falsy*, you may use it in Boolean expressions

```
let surname = undefined;
if (book) {
    if (book.author) {
        surname = book.author.surname;
    }
}
```

```
surname = book && book.author && book.author.surname;
```

Iterating over properties

- `for .. in` iterates over the properties

```
for( let a in {x: 0, y:3}) {
     console.log(a) ;
}
```

```
x
y
```

```
let book = {
  author : "Enrico",
  pages: 340,
  chapterPages: [90,50,60,140],
};

for (const prop in book)
  console.log(`${prop} = ${book[prop]}`);
```

```
author = Enrico
pages = 340
chapterPages = 90,50,60,140
```

Iterating over properties

- All the (enumerable) properties names (keys) of an object can be accessed as an array, with:
  - `let keys = Object.keys(my_object) ;`

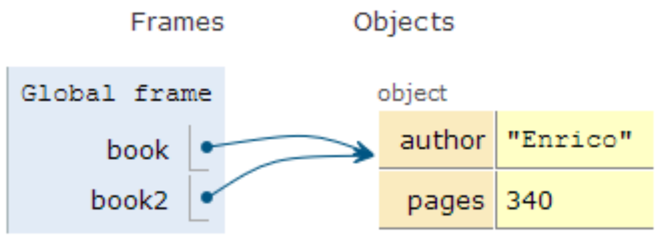
```
[ 'author', 'pages' ]
```

- All pairs [key, value] are returned as an array with:
  - `let keys_values = Object.entries(my_object)`

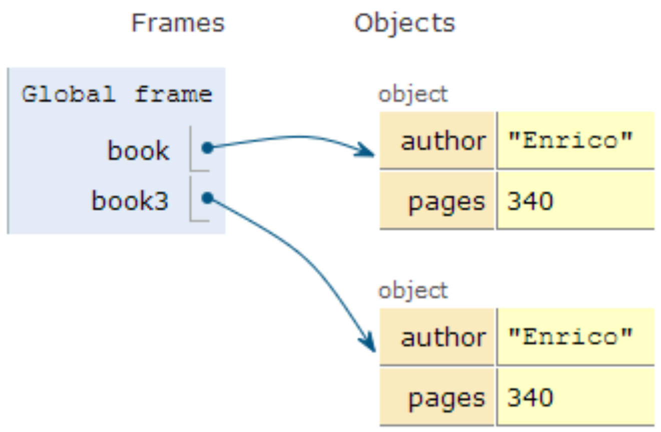
```
[ [ 'author', 'Enrico' ], [ 'pages', 340 ] ]
```

Copying objects

```
let book = {
  author : "Enrico",
  pages: 340,
};

let book2 = book;   // ALIAS
```



```
let book = {
  author : "Enrico",
  pages: 340,
};

let book3 =                 // COPY
   Object.assign({}, book);
```



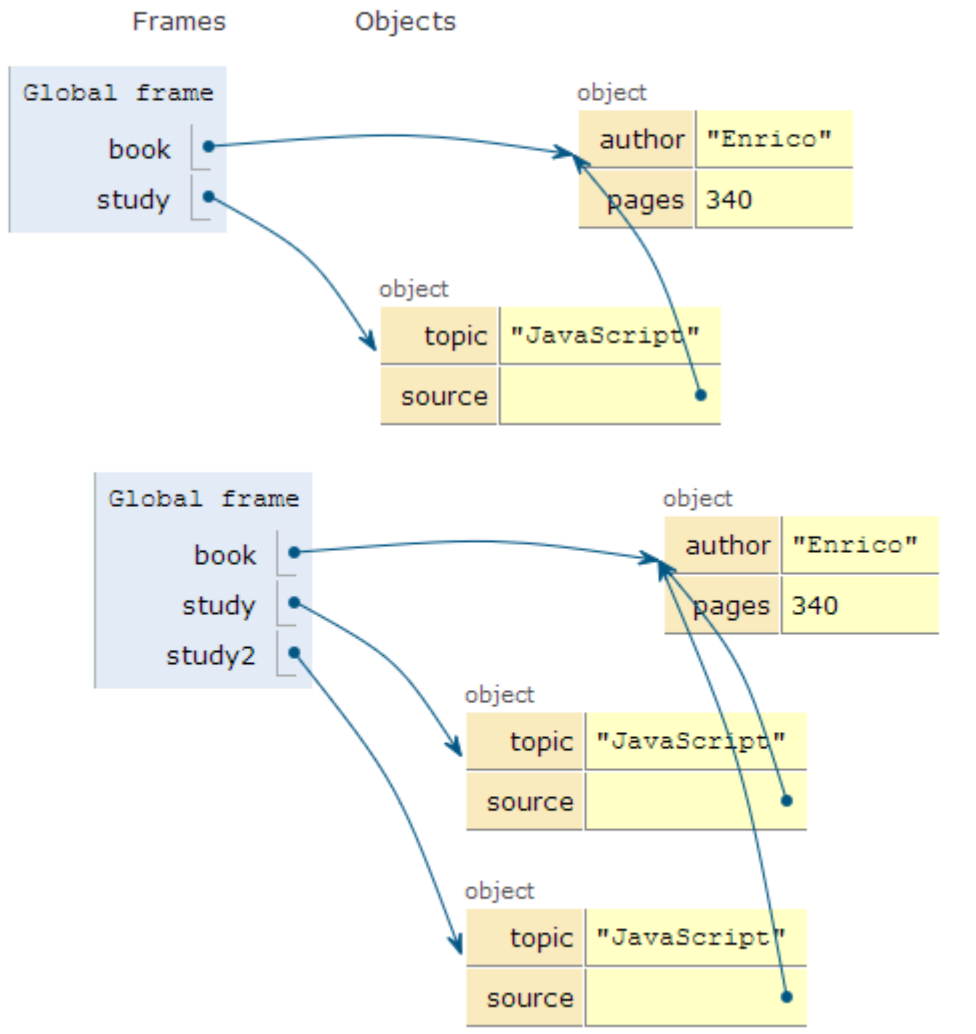
`Object.assign`

- `let new_object = Object.assign(target, source);`
- Assigns all the properties from the source object to the target one
- The target may be an existing object
- The target may be a new object: `{}`
- Returns the target object (after modification)

Beware! Shallow copy, only

```
let book = {
  author : "Enrico",
  pages: 340,
};

let study = {
  topic: "JavaScript",
  source: book,
};
```

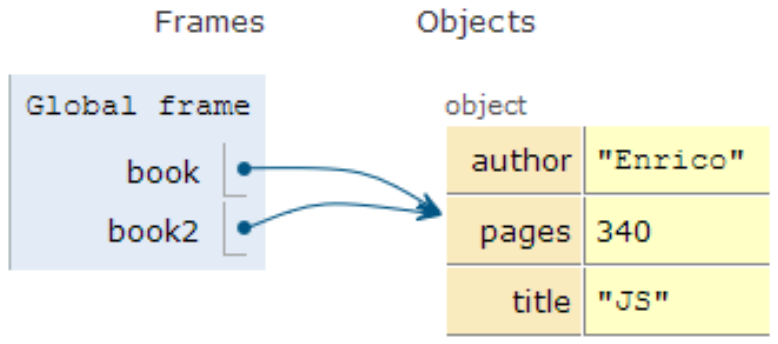
```
let study2 = Object.assign({},
study);
```



Merge properties (on existing object)

- `Object.assign(target, source, default values, ..);`

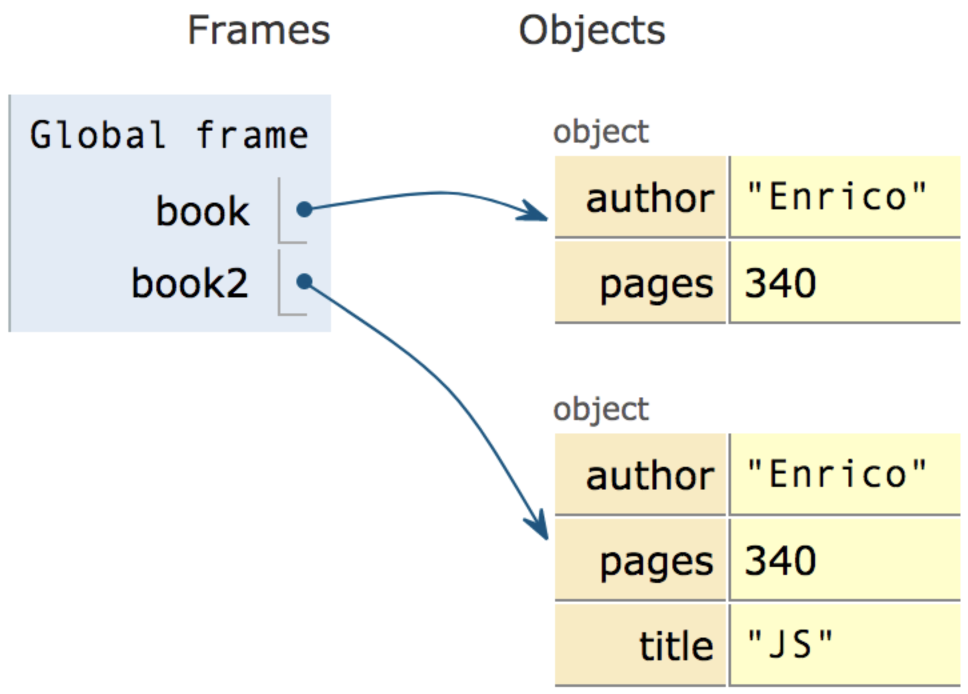
```
let book = {
  author : "Enrico",
  pages: 340,
};

let book2 = Object.assign(
 book, {title: "JS"}
);
```



Merge properties (on new object)

- `Object.assign(target, source, default values, ..);`

```
let book = {
  author : "Enrico",
  pages: 340,
};

let book2 = Object.assign(
 {}, book, {title: "JS"}
);
```



Copying with spread operator (**ES9** – ES2018)

```
let book = {
  author : "Enrico",
  pages: 340,
};

let book2 = {...book, title: "JS"};
let book3 = { ...book2 } ;
console.log(book2);
```

```
{ author: 'Enrico', pages: 340, title: 'JS' }
```

```
const {a,b,...others} =
   {a:1, b:2, c:3, d:4};

console.log(a);
console.log(b);
console.log(others);
```

```
1
2
{ c: 3, d: 4 }
```

Checking if properties exist

- Operator **`in`**
  - Returns true if property is in the object. Do <u>not</u> use with Array

```
let book = {
  author : "Enrico",
  pages: 340,
};

console.log('author' in book);
delete book.author;
console.log('author' in book);
```

```
true
false
```

```
const v=['a','b','c’];

console.log('b' in v);



console.log('PI' in Math);
```

```
false
true
```

Object creation (equivalent methods)

- By object literal: `const point = {x:2, y:5} ;`
- By object literal (empty object): `const point = {} ;`

Preferred

- By constructor: `const point = new Object() ;`
- By object static method create:
  `const point = Object.create({x:2,y:5}) ;`
- Using a *constructor function*

JavaScript: The Definitive Guide, 7th Edition
Chapter 7. Functions

JavaScript – The language of the Web

FUNCTIONS

Functions

- One of the most important elements in JavaScript
- Delimits a block of code with a private scope
- Can accept parameters and returns one value
  - Can also be an object
- Functions themselves **are objects** in JavaScript
  - They can be assigned to a variable
  - Can be passed as an argument
  - Used as a return value

Declaring functions: 3 ways

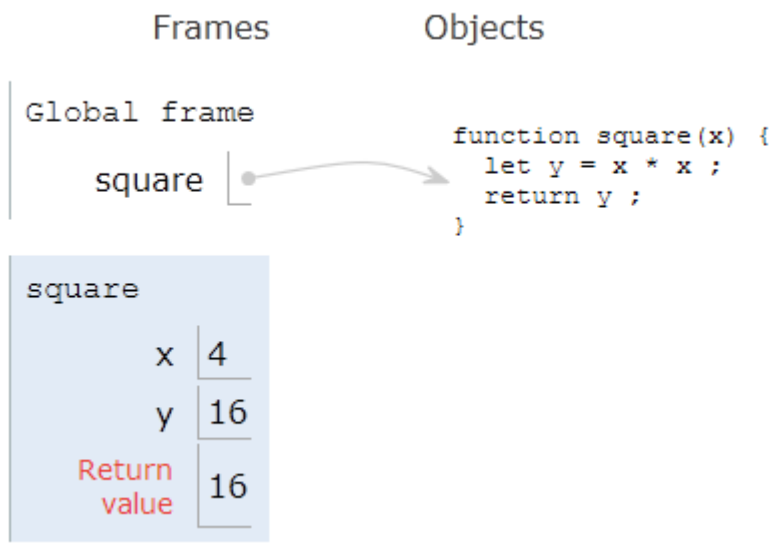
1) Classic

```
function do(params) {
  /* do something */
}
```

Classic functions

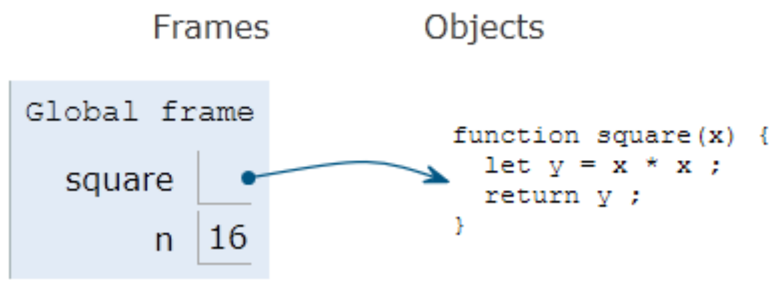
```
function square(x) {
  let y = x * x ;
  return y ;
}

let n = square(4) ;
```

During execution



```
function square(x) {
  let y = x * x ;
  return y ;
}
```

After execution



```
function square(x) {
  let y = x * x ;
  return y ;
}
```

Parameters

- Comma-separated list of parameter names
  - May assign a default value, e.g., `function(a, b=1) {}`
- Parameters are passed by-value
  - Copies of the reference to the object
- Parameters that are not passed in the function call get the value 'undefined'
- Check missing/optional parameters with:
  - `if(p===undefined) p = default_value ;`
  - `p = p || default_value ;`

Variable number of parameters

- Syntax for functions with variable number of parameters, using the `...` operator (called “rest”)

  ```
  function fun (par1, par2, ...arr) { }
  ```

- The “rest” parameter must be the last, and will deposit all extra arguments into an array

  ```
  function sumAll(initVal, ...arr) {
    let sum = initVal;
    for (let a of arr) sum += a;
    return sum;
  }
  sumAll(0, 2, 4, 5); // 11
  ```

Declaring functions: 3 ways

1) Classic

```
function do(params) {
  /* do something */
}
```

2a) Function expression

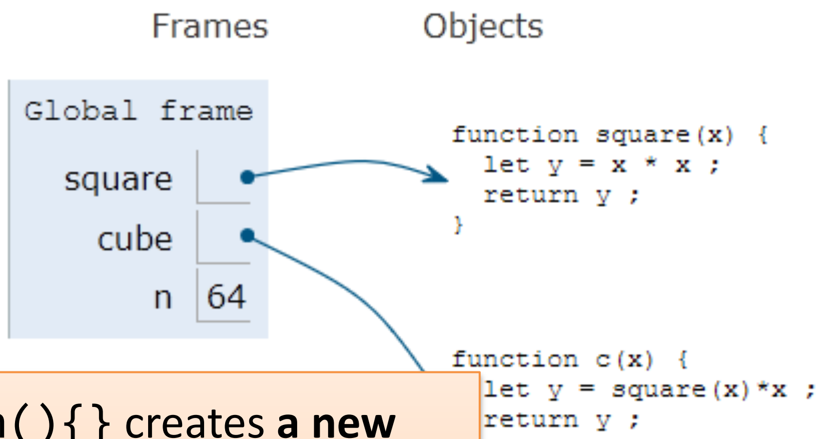
```
const fn = function(params) {
  /* do something */
}
```

2b) Named function expression

```
const fn = function do(params) {
  /* do something */
}
```

Function expression: indistinguishable

```
function square(x) {
  let y = x * x ;
  return y ;
}

let cube = function c(x) {
  let y = square(x)*x ;
  return y ;
}

let n = cube(4) ;
```



```
function square(x) {
  let y = x * x ;
  return y ;
}
```

```
function c(x) {
  let y = square(x)*x ;
  return y ;
```

The *expression* `function(){}` creates **a new object of type 'function'** and returns the result.

Any variable may "refer" to the function and call it. You can also store that reference into an array, an object property, pass it as a parameter to a function, redefine it, …

method

callback

Declaring functions: 3 ways

1) Classic

```
function do(params) {
  /* do something */
}
```

2a) Function expression

```
const fn = function(params) {
  /* do something */
}
```

3) Arrow function

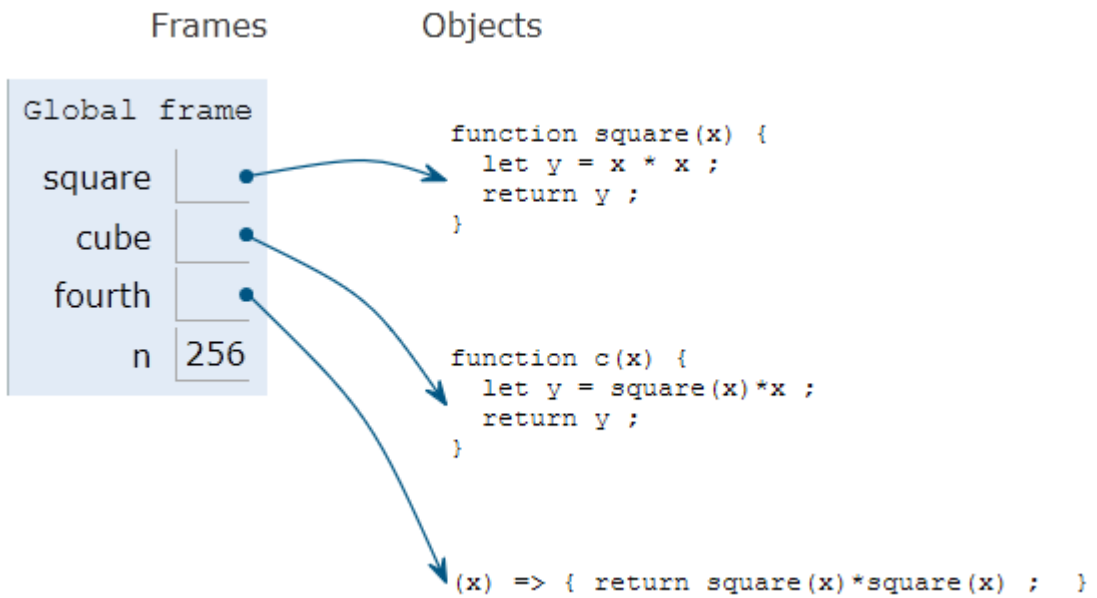
```
const fn = (params) => {
  /* do something */
}
```

2b) Named function expression

```
const fn = function do(params) {
  /* do something */
}
```

Arrow Function: just a shortcut

```
function square(x) {
  let y = x * x ;
  return y ;
}

let cube = function c(x) {
  let y = square(x)*x ;
  return y ;
}

let fourth = (x) => { return
square(x)*square(x) ;  }

let n = fourth(4) ;
```



```
function square(x) {
  let y = x * x ;
  return y ;
}
```

```
function c(x) {
  let y = square(x)*x ;
  return y ;
}
```

```
(x) => { return square(x)*square(x) ;  }
```

Parameters in arrow functions

```
const fun = () => {  /* do something */ }          // no params

const fun = param => {  /* do something */ }       // 1 param

const fun = (param) => {  /* do something */ }     // 1 param

const fun = (par1, par2) => {  /* smtg */ } // 2 params

const fun = (par1 = 1, par2 = 'abc') => {  /* smtg */ }   // default values
```

Return value

- Default: `undefined`
- Use `return` to return a value
- Only one value can be returned
- However, objects (or arrays) can be returned

```
const fun = () => {  return ['hello', 5] ; }
const [ str, num ] = fun() ;
console.log(str) ;
```

- Arrow functions have implicit return if there is only one value

```
let fourth = (x) => { return square(x)*square(x) ;  }
let fourth = x => square(x)*square(x) ;
```

Nested functions

- Function can be nested, i.e., defined within another function

```
function hypotenuse(a, b) {
    const square = x => x*x ;
    return Math.sqrt(square(a) + square(b));
}
```

=> Preferred in nested functions

```
function hypotenuse(a, b) {
    function square(x) { return x*x; }
    return Math.sqrt(square(a) + square(b));
}
```

- The inner function is *scoped within* the external function and cannot be called outside
- The inner function might *access variables declared* in the *outside* function

Closure: definition (somewhat cryptic)

A **closure** is a name given to a feature in the language by which a **nested** function executed **after** the execution of the outer function can still access **outer function's scope**.

Really: one of the most important concepts in JS

https://medium.com/@vvkchandra/learn-javascript-closures-through-the-laws-of-karma-49d32d35b3f7

Closures

- JS uses *lexical scoping*
  - Each new functions defines a *scope* for the variables declared inside
  - Nested functions may access the scope of *all enclosing* functions
- Every function object remembers the scope where it is defined, even after the external function is no longer active → Closure

```
"use strict" ;

function greeter(name) {
    const myname = name ;

    const hello = function () {
        return "Hello " + myname ;
    }

    return hello ;
}

const helloTom = greeter("Tom") ;
const helloJerry = greeter("Jerry") ;

console.log(helloTom()) ;
console.log(helloJerry()) ;
```

Warning: not `return hello() ;`

Closures

- hello accesses the variable myname, defined in the outer scope
- The function is returned (as helloTom or helloJerry)
- Each of the functions “remembers” the reference to myname, when it was defined
- The variable myname goes out of scope, but is not destroyed
  - Still accessible (referred) by the hello functions.

```
"use strict" ;

function greeter(name) {
    const myname = name ;

    const hello = function () {
        return "Hello " + myname ;
    }

    return hello ;
}

const helloTom = greeter("Tom") ;
const helloJerry = greeter("Jerry") ;

console.log(helloTom()) ;
console.log(helloJerry()) ;
```

greeter scope

hello scope

Using closures to emulate objects

```
"use strict" ;

function counter() {
    let value = 0 ;

    const getNext = () => {
        value++;
        return value;
    }

    return getNext ;
}
```

```
const count1 = counter() ;
console.log(count1()) ;
console.log(count1()) ;
console.log(count1()) ;

const count2 = counter() ;
console.log(count2()) ;
console.log(count2()) ;
console.log(count2()) ;
```

```
1
2
3
1
2
3
```

Using closures to emulate objects (with methods)

```
"use strict";

function counter() {
    let n = 0;

    // return an object,
    // containing two function-valued
    // properties
    return {
        count: function() {
            return n++; },
        reset: function() { n = 0; }
    };
}
```

```
let c = counter(), d = counter();
       // Create two counters

c.count()
       // => 0

d.count()
       // => 0: they count independently

c.reset()
       // reset() and count() methods

c.count()
       // => 0: because we reset c

d.count()
       // => 1: d was not reset
```

Immediately Invoked Function Expressions (IIFE)

- Functions may protect the *scope* of variables and inner functions
- May declare a function
  - With internal variables
  - With inner functions
  - Call it only once, and discard everything

```
( function() {
    let a = 3 ;
    console.log(a) ;
} ) () ;
```

```
let num = ( function() {
    let a = 3 ;
    return a ;
} ) () ;
```

https://flaviocopes.com/javascript-iife/

https://medium.com/@vvkchandra/essential-javascript-mastering-immediately-invoked-function-expressions-67791338ddc6

Using IIFE to emulate objects (with methods)

```
"use strict";

const c = (
    function () {
        let n = 0;

        return {
            count: function () {
                return n++; },
            reset: function () {
                n = 0; }
        };
    })();
```

```
console.log(c.count());
console.log(c.count());
c.reset();
console.log(c.count());
console.log(c.count());
```

```
0
1
0
1
```

Construction functions

- Define the object type
  - Use a capital initial letter
  - Set the properties with the keyword **this**
- Create an instance of the object with **new**

```
function Car(make, model, year) {
  this.make = make;
  this.model = model;
  this.year = year;
  this.isNew = ()=>(year>2000);
}
```

```
let mycar = new Car('Eagle',
'Talon TSi', 1993);
```

JavaScript: The Definitive Guide, 7th Edition
Chapter 9.4 Dates and Times

Mozilla Developer Network
Web technology for developers » JavaScript » JavaScript reference »
Standard built-in objects » Date

Day.js
https://day.js.org/en/

JavaScript – The language of the Web

DATES

Date object

- Store a time instant with *millisecond* precision, counted from Jan 1, 1970 UTC (Unix Epoch)
- Careful with time zones
  - Most methods work in local time (not UTC) the computer is set to

```
let now = new Date();
```

```
let newYearMorning = new Date(
2021, // Year 2021
0, // January (from 0)
1, // 1st
18, 15, 10, 743);
// 18:15:10.743, local time
```

UTC vs Local time zone are confusing.

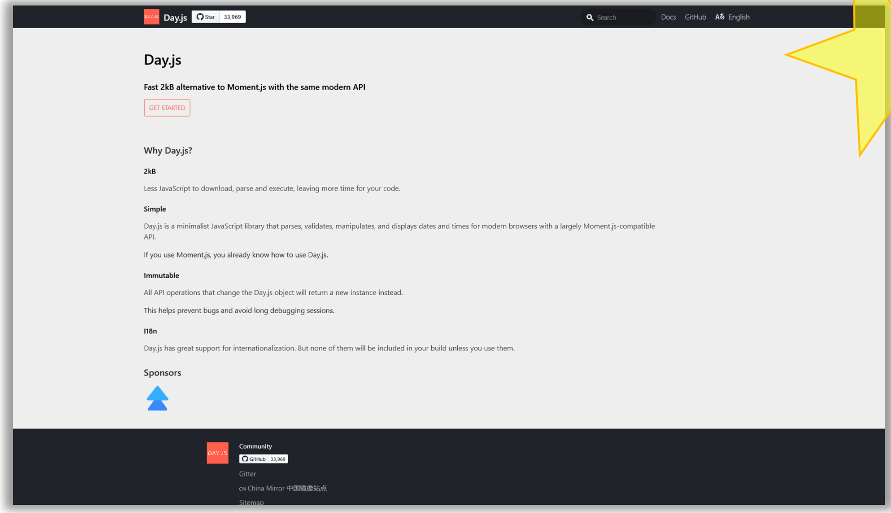
```
> new Date('2020-03-18')
2020-03-18T00:00:00.000Z
> new Date('18 March 2020')
2020-03-17T23:00:00.000Z
```

😱

Formatting is locale and implementation dependent 😱 😱

Comparisons are difficult (no way to specify which fields you want, must set them to zero explicitly) 😱 😱 😱

Serious JS date/time handling libraries



Day.js Star 33,969 Search Docs GitHub English

Day.js

Fast 2kB alternative to Moment.js with the same modern API

GET STARTED

Why Day.js?

2kB

Less JavaScript to download, parse and execute, leaving more time for your code.

Simple

Day.js is a minimalist JavaScript library that parses, validates, manipulates, and displays dates and times for modern browsers with a largely Moment.js-compatible API.

If you use Moment.js, you already know how to use Day.js.

Immutable

All API operations that change the Day.js object will return a new instance instead.

This helps prevent bugs and avoid long debugging sessions.

I18n

Day.js has great support for internationalization. But none of them will be included in your build unless you use them.

Sponsors

Community

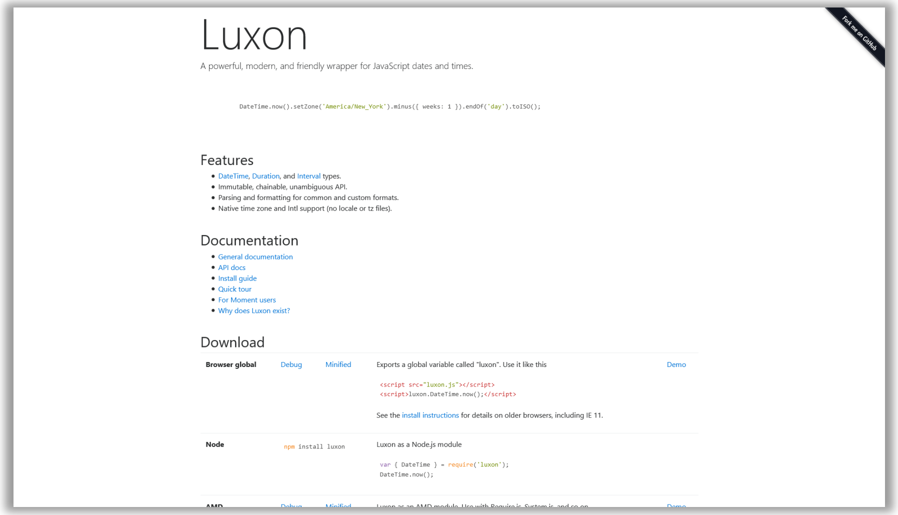
GitHub 33,969

Gitter

CN China Mirror 中国镜像站点

Sitemap

https://day.js.org/



Luxon

A powerful, modern, and friendly wrapper for JavaScript dates and times.

```
DateTime.now().setZone('America/New_York').minus({ weeks: 1 }).endOf('day').toISO();
```

Features

- DateTime, Duration, and Interval types.
- Immutable, chainable, unambiguous API.
- Parsing and formatting for common and custom formats.
- Native time zone and Intl support (no locale or tz files).

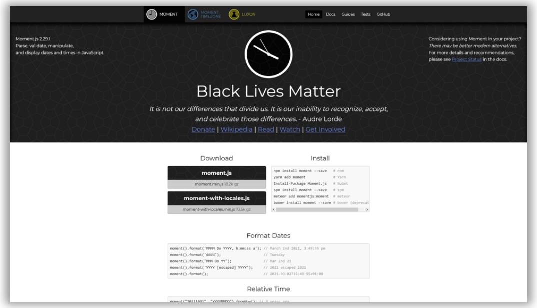
Documentation

- General documentation
- API docs
- Install guide
- Quick tour
- For Moment users
- Why does Luxon exist?

Download

Browser global	Debug	Minified	Exports a global variable called "luxon". Use it like this `<script src="luxon.js"></script>` `<script>luxon.DateTime.now();</script>` See the install instructions for details on older browsers, including IE 11.	Demo
Node	`npm install luxon`		Luxon as a Node.js module `var { DateTime } = require('luxon');` `DateTime.now();`	

https://moment.github.io/luxon/



Black Lives Matter

It is not our differences that divide us. It is our inability to recognize, accept, and celebrate those differences. - Audre Lorde

Donate | Wikipedia | Read | Watch | Get Involved

Download Install

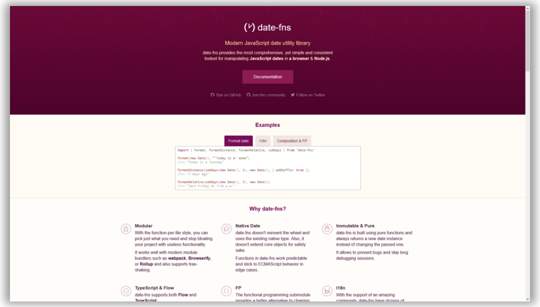
moment.js

moment-with-locales.js

Format Dates

Relative Time

https://momentjs.com/



date-fns

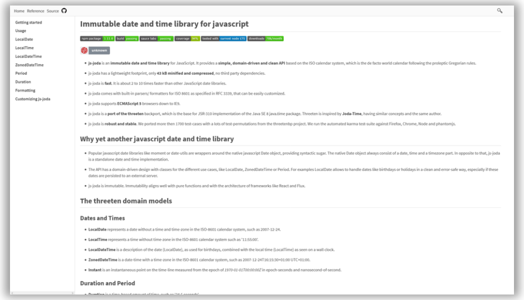
Modern JavaScript date utility library

Documentation

Examples

Why date-fns?

https://date-fns.org/



Immutable date and time library for javascript

Why yet another javascript date and time library

The threeten domain models

Dates and Times

Duration and Period

https://js-joda.github.io/js-joda/

Day.js Library

DAY.JS https://day.js.org/

- Goals
  - Compatible with moment.js
    - But very small (2kB)
  - Works in nodejs and in the browser
  - All objects are *immutable*
    - All API functions that modify a date, will always return a new object instance
  - Localization
  - Plugin system for extending functionality

- Install

```
npm init # if not already done
npm install dayjs
```

- Import

```
const dayjs = require('dayjs')
```

- Use

```
let now = dayjs()
console.log(now.format())
```

Basic operations with Day.js

Creating date objects – dayjs() constructor

```
let now = dayjs()  // today
let date1 = dayjs('2019-12-27T16:00');
        // from ISO 8601 format
let date2 = dayjs('20191227');
        // from 8-digit format
let date3 = dayjs(new Date(2019, 11, 27));
        // from JS Date object
let date5 = dayjs.unix(1530471537);
    // from Unix timestamp

By default, Day.js parses in local time
```

https://day.js.org/docs/en/parse/parse

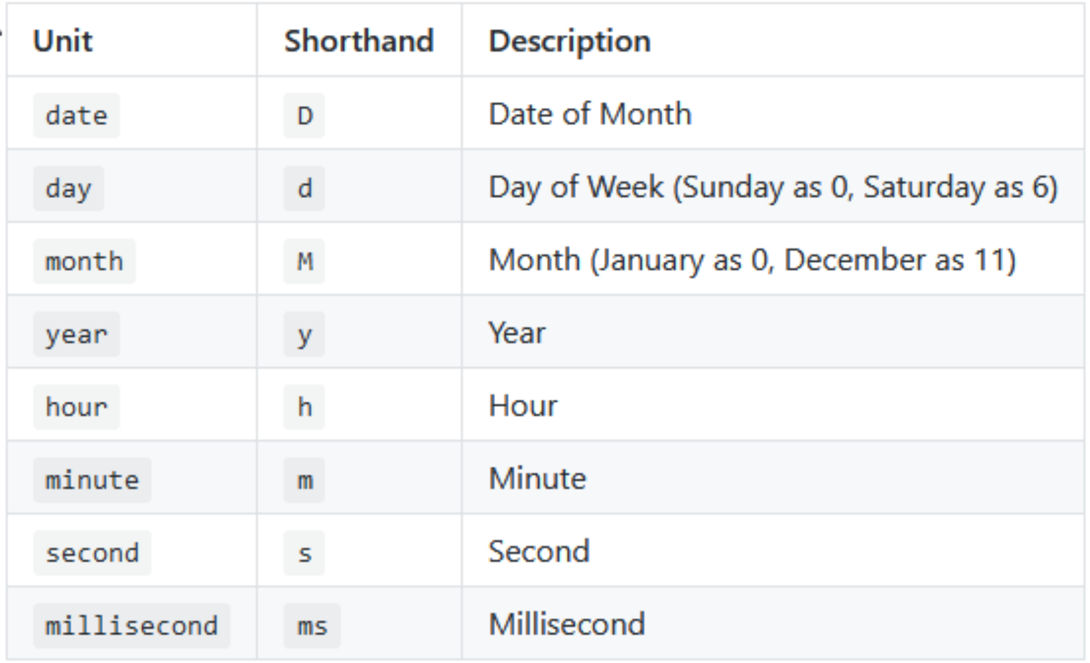
Displaying date objects – format()

```
console.log(now.format());
        2021-03-02T16:38:38+01:00

console.log(now.format('YYYY-MM [on the] DD'));
        2021-03 on the 02

console.log(now.toString());
        Tue, 02 Mar 2021 15:43:46 GMT

By default, Day.js displays in local time
```

Get/Set date/time components

```
# obj.unit() -> get
# obj.unit(new_val) -> set

let now2 = now.date(15);
let now2 = now.set('date', 15);
        2021-03-15T16:50:26+01:00

let now3 = now.minute(45);
let now3 = now.set('minute',45);
        2021-03-02T16:45:26+01:00

let today_day = now.day();
let today_day = now.get('day');
        2
```

https://day.js.org/docs/en/get-set/get-set



Unit	Shorthand	Description
`date`	`D`	Date of Month
`day`	`d`	Day of Week (Sunday as 0, Saturday as 6)
`month`	`M`	Month (January as 0, December as 11)
`year`	`y`	Year
`hour`	`h`	Hour
`minute`	`m`	Minute
`second`	`s`	Second
`millisecond`	`ms`	Millisecond

Date Manipulation and Comparison

```
let wow = dayjs('2019-01-25').add(1, 'day').subtract(1, 'year').year(2009).toString() ;
// "Sun, 25 Jan 2009 23:00:00 GMT"
```

- Methods to "modify" a date (and return a modified one)
- `.add` / `.subtract`
- `.startOf` / `.endOf`
- `d1.diff(d2,` *'unit'*`)`
- Specify the unit to be added/subtracted/rounded
- Can be easily *chained*

- Day.js objects can be compared
- `.isBefore` / `.isSame` / `.isAfter`
- `.isBetween`
- `.isLeapYear` / `.daysInMonth`

Day.js Plugins

- To keep install size minimal, several functions are only available in *plugins*
- Plugins must be
  - Loaded
  - Registered into the libraries
- Then, functions may be freely used

```
const isLeapYear =
   require('dayjs/plugin/isLeapYear’) ;
         // load plugin

dayjs.extend(isLeapYear) ;
         // register plugin

console.log(now.isLeapYear()) ;
         // use function
```

Advanced Day.js Topics

- Localization / Internationalization
  - Language-aware and locale-aware parsing and formatting
  - Various formatting patterns for different locales/languages
- Durations
  - Measuring time intervals (the difference between two time instants)
  - Interval arithmetic
- Time Zones
  - Conversion between time zones

License